

## Vanadium leaching from converter lime and speciation in soil: a long-term field study

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Vanadium, V, is a redox-sensitive metal that is mainly used within the steel industry. Under environmental conditions, it mainly exists in oxidation states +4 and +5 [1]. Under aerobic conditions vanadium prevails as the pentavalent oxyanion vanadate,  $\text{H}_2\text{VO}_4^-$ . Vanadate is thought to be the most toxic vanadium form due to its structural similarity to phosphate [2].

In the mid-1980's, a field trial was set up in a pine forest in the south of Sweden. Granulated converter lime, containing high concentrations of vanadium, was added in different concentrations (0, 2, 7 and 10 tonne  $\text{ha}^{-1}$ ). 25 years later, soil samples from the mor and from the top 20 cm of the mineral layer were taken at the site. The soils were analyzed for total and dissolved vanadium concentrations. Further, the redox form of the vanadium bound to the soils was analysed using X-ray absorption near edge structure (XANES) spectroscopy. Quantification of vanadium(IV) and vanadium(V) in the soil extracts was made with EDTA complexation followed by measurements with HPLC coupled ICP-MS [3].

The total soil vanadium concentrations generally decreased with depth, indicating some downward transport of vanadium in the profile. XANES spectra in the mor layer show similarities to reference samples of V(IV) bound to organic matter. Further down in the mineral soil, the XANES spectra suggests vanadium(V) binding to soil constituents containing aluminium. The speciation analysis of the  $\text{CaCl}_2$ -extracts showed a higher fraction of V(IV) in samples with higher concentrations of organic matter such as in the mor samples. The extracts of the mineral soils had a larger fraction of V(V).

[1] Wanty & Goldhaber, 1992. *Geochim. Cosmochim. Acta* 56, 1471-1483. [2] Seargeant & Stinson, 1979. *Biochem. J.* 181, 247-250. [3] Aureli, Ciardullo, Pagano, Raggi & Cubadda, 2008. *J. Anal. At. Spectrom.* 23, 1009-1016.

## Processed controlling recent lava fountaining activity on Mt. Etna, revealed using remote sensing measurements of volcanic gases

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Open-Path Fourier Transform Infrared (OP-FTIR) spectroscopy is now an established methodology for measuring volcanic gas compositions remotely. Here we present and interpret OP-FTIR measurements collected on Mt. Etna, before, during and after a series of lava fountains which were observed between 2011 and 2013. We combine our results with quantifications of  $\text{SO}_2$  flux, allowing the fluxes of multiple volcanic gas species to be constrained, including  $\text{H}_2\text{O}$ ,  $\text{CO}_2$ ,  $\text{SO}_2$ ,  $\text{HCl}$ , and  $\text{HF}$ . These results allow an interpretative framework to be established, in which we use clearly observed geochemical precursors to the lava fountain activity to constrain the magma dynamics which produce the eruptive activity.